Obesity in the University Setting: An Assessment of Risk Factors Associated with College-aged Overweight and Obesity

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Table of Contents

Page

I. Abstract....4

II. Introduction....5

III. Addendum to Introduction....6

a. Obesity Related Lifestyle Factors....7

i. Dietary Factors....7

ii. Physical Activity....8

b. Disordered Eating in Young Adults....8

i. Binge Eating Disorder and Overweight/Obesity....9

ii. Overweight/Obesity and Purging Behaviors....11

IV. Purpose of this Study....12

V. Methods....13

a. Survey Instrument and Administration....13

b. Outcomes....14

c. Statistical Analysis....14

VI. Results....15

VII. Discussion....18

VIII. Addendum to Discussion....22

a. Biological considerations....22

b. Overweight/Obesity vs DSM-IV diagnosed ED....23

c. Overweight/Obesity and BED: How different are they?....24

d. Overweight/Obesity and Bingeing Behaviors....26

e. EAT-26 and Screening for Overweight/Obesity....26

f. Overweight/Obesity and Age.....27

g. Overweight/Obesity and Social Affiliation.....28

h. Overweight/Obesity and Previous Treatment for Eating Disorders.....29

i. Future directions.....30

IX. Acknowledgements.....31

X. Figures and Tables.....32

XI. References.....36

Abstract

Objective: Overweight and obesity are increasing among college students, but risk factors have not been evaluated in this population. In this study, we assesses whether abnormal eating perceptions and disordered eating behaviors are associated with a higher frequency of overweight in college students. We also evaluate potential screening questions for overweight young adults. *Research Methods:* A sample of undergraduates at three universities (n=4201) voluntarily completed an electronic survey containing demographic questions and the Eating Attitudes Test-26 (EAT-26) questionnaire. Subjects were stratified by BMI classifications of normal weight and overweight/obese, and these groups were evaluated for their relationship with EAT-26 score, purging behaviors, and routine physical activity. Questions expected to be useful screening questions for overweight were selected from the EAT-26 survey and assessed for their relationship to overweight. *Results:* A modified EAT-26 score of $\geq$11 was associated with overweight ($p=0.016$). Compared to normal weight subjects, overweight subjects also displayed an increased fear of bingeing, preoccupation with food, desire to be thinner, and dieting behaviors. Mean BMI increased with age and was higher in those reporting physical inactivity ($p<0.001$). *Discussion:* College students who report physical inactivity are more likely to be overweight/obese than their peers. These students are also more likely to report disordered eating perceptions and behaviors. The findings suggest that identification of

obesity specific risk factors may facilitate the development of effective screening and treatment interventions for young adult obesity.

Introduction

Overweight and obesity are increasing among college students. According to the National College Health Risk Behavior Study, 13.9% of college women and 17.2% of college men between the ages of 18-24 are currently overweight or obese[1]. Independent living in a university environment allows young adults increased freedom to alter their diet, level of physical activity, and other lifestyle habits; thus, the college years are highly influential in shaping adult behaviors[2]. Interventions aimed at the college population may help reduce the rate of overweight during the transition from adolescence to adulthood and thereby prevent some of the long-term health consequences of obesity, which include coronary heart disease, hypertension, type 2 diabetes, and dyslipidemia[3].

Obesity in adolescence tends to persist into adulthood. Both the National Longitudinal Study of Adolescent Health and the National Health and Nutrition Examination Survey have found that during the transition from adolescence to young adulthood, the proportion of adolescents becoming obese and remaining obese is high[4]. Additionally, since obesity is not easily reversible, those who are obese or develop obesity as young adults are at increased risk of obesity through adulthood[5]. Although these studies highlight important patterns, they have not identified abnormal

eating attitudes or specific behaviors that may lead to obesity during the transition from adolescence to adulthood. Therefore, in order to characterize the abnormal eating attitudes and behaviors linked to overweight and obesity in early adulthood, we examined data that was collected via an electronic, cross-sectional survey of undergraduate students at three large, geographically similar universities.

Addendum to Introduction

Numerous studies have assessed the prevalence of disordered eating in college-aged populations and have been able to identify several high risk groups. Such groups include students attending private institutions, dance majors, ballerinas, and Greek life affiliates[6, 7]. Additionally, evaluation long-distance runners, found that while only a small proportion of student athletes suffer from the athletic triad syndrome characterized by disordered eating, menstrual irregularity, and low bone density, a much higher proportion, ranging from 15-62%, report having an eating disorder or disordered eating behaviors[8, 9]. Obesity risk factors, however, have yet to be evaluated in the college population and given that the rates of overweight and obesity have reached epidemic proportions, potentially associated risk factors deserve further consideration.

Obesity Related Lifestyle Factors

Overweight and obesity stems from an underlying energy imbalance in one's daily routine. If more calories are consumed than are expended, one will inevitably gain weight. Therefore, many interventions aimed at treating the epidemic have targeted one or both of two core components: diet and exercise.

Dietary Factors

Through the use of surveys and various dietary assessments, six studies since 1997 have found that many college students, with prevalence ranging from 22% to 69%, are not meeting their dietary needs as recommended by the USDA[10-15]. More specifically, national estimates of dietary habits in young adults between the ages of 18-24 report that less than 22% of young adults meet their recommended daily fruit and vegetable allowances[12].

Dietary assessments also reveal that in addition to inadequate nutrition, eating patterns are also poorly developed in some college students. For instance, in a study of 1912 college students, 22% skipped breakfast, 8% skipped lunch, and 5% skipped dinner. Habits such as increased amounts of snacking, increased consumption of high-fat "junk food", and dining at all-you-can-eat cafeterias contribute to the poor eating habits that are promoting weight gain in university students[16, 17].

Physical Activity

Some studies have found that despite the poor eating habits that manifest in college, mean caloric intake in college freshman may actually decrease overall. Yet at the same time, body weight tends to increase during the college years, suggesting that physical activity must also be decreasing during the transition from high school to college. With respect to physical activity, it is widely believed that the prevalence of a sedentary lifestyle increases with age. For college students, seven studies from 1997 have shown that anywhere from 20-68% of college students do not meet physical activity guidelines[10, 13, 15, 18-21].

Although habits such as poor exercise and inadequate nutrition are not specific to overweight/obese college students, the patterning of such behaviors may occur more frequently in the college environment, and thus, warnings about the infamous "freshman 15" weight gain may actually have some merit. Because of behavioral changes that are developed in college, young adults are especially at risk for becoming overweight during the college years and then perpetuating overweight from adolescence into young adulthood[11, 12, 22].

Disordered Eating in Young Adults

In addition to an increased risk of overweight, college-aged young adults are also at increased risk for developing eating disorders. The

overall prevalence for diagnosed eating disorders in college students is reported between 1.3% and 5%[23]. More alarming, however, is that an additional 17% of college students are at risk for eating disorders yet remain undiagnosed because they either do not seek treatment or are never appropriately evaluated for a disorder[24].

More specifically, late adolescence and early adulthood are known as the time when youth, especially women, are most at risk for developing anorexia nervosa (AN) and bulimia nervosa (BN). Community evaluations of eating disorders show that AN has a peak onset between the ages of 10-19 while BN peaks between 20-39 years[25-27]. Binge eating disorder (BED) is another disorder that also has a peak incidence in young adulthood, at 23.2 years. BED, however, is slightly different from either AN or BN because it is associated with populations that tend to be normal weight or overweight rather than underweight[28, 29].

Binge Eating Disorder and Overweight/Obesity

BED is a disorder characterized by bingeing episodes with occasional or without compensatory behaviors such as purging, laxative use, and excessive exercise (Table 1)[30, 31]. Because of the increased dietary intake inherent in BED, the disorder is associated with a lifetime history of obesity and unstable weight. However, despite the connection between BED and obesity, the precise relationship remains uncertain. Accordingly, while approximately half of those with BED are also obese,

four analyses since 1992 have determined that anywhere from 2-20% of obese persons actually meet the criteria for BED[29, 32-34]. Further complicating the relationship is the question of which comes first, bingeing or overweight? Some subjects report being normal weight before their first bingeing episode, while others report being overweight before they developed bingeing tendencies[28, 35].

Although the exact causal pathway linking obesity with BED remains unclear, most agree that obese persons with binge eating habits are distinct from those without bingeing behaviors in terms of their risk factor profiles and outcomes[32, 36-39]. One difference between the two groups is that persons with bingeing tendencies have lower self-esteems, increased perfectionist attitudes, increased impulsivity, more feelings of ineffectiveness, and a longer dieting history compared to obese persons without bingeing habits. Binge eaters also have a greater tendency toward maladaptive dietary behavior such as dietary restraint and emotional eating. They tend to engage in such habits at a younger age, and thus develop obesity earlier than those without BED[33, 40-42].

This finding has two serious implications. The first supports the notion that obesity with and without bingeing tendencies differ with respect to disease etiology and progression. The second suggests that in light of this difference, unique treatment programs may be needed for each group.

Overweight/Obesity and Purging Behaviors

Given that there exists a subgroup of BED within the obese population, the question remains as to whether there is also a subgroup of obese persons with purging tendencies. Historically, there has been an association between bingeing and purging behaviors yet as the college population strives for thinness, the incidence of binge eating has decreased among cohorts while purging behaviors have remained stable[43].

As obesity becomes a problem of increasing significance in the adolescent population, are more students engaging in purging behaviors as an attempt to compensate for their increased weight? Cross-sectional studies of middle school and high school adolescents show that those who are overweight/obese have a greater risk than their thinner peers of purging through self-induced vomiting and laxative use[44]. Furthermore, of college students trying to lose weight, only 54% of females and 41% of males used both exercise and diet control for weight loss. More specifically, the two studies that have specifically addressed purging behaviors have revealed self-reported purging prevalence rates between 2% to 7% in those trying to lose weight [45, 46]. Such data indicate that unhealthy weight loss patterns permeate through the university environment[47].

Purpose of This Study

In general, dieting is associated with an increased onset of disordered eating symptoms including both restrictive and purging behaviors[27, 48, 49]. Given that obese youth often diet, they are at particular risk for eating disorders. Additionally, since college is a time when disordered eating peaks and body weight dissatisfaction is often the greatest[50], it is possible to use this group as a sample population in which to better elucidate the factors that are most influencing the obesity epidemic.

One question that surfaces from this investigation is that of how obesity is related to abnormal perceptions of eating as measured by the Eating Attitudes Test (EAT)-26. The EAT-26 is an eating inventory that is most commonly used internationally and in the US to assess for eating disorders. And although AN and BN are known to correlate with increased scores on the EAT-26[51, 52], use of this survey in obese populations remains unexplored. Further examination of this association may provide us with a tool that can be useful not only in screening for eating disorders, but also for overweight/obesity.

Furthermore, evaluation of both bingeing and purging behaviors as well as perceptions of eating in the college population may help better clarify the association, if any, between disordered eating attitudes and overweight/obesity. Such associations may provide a better understanding of the obesity risk factors that are common to young adult

populations and hopefully aid in the development of more effective screening tools and treatment programs for those most in danger of overweight/obesity.

Methods

Survey Instrument and Administration

In January 2002, undergraduates at three North Carolina universities received a recruitment email with nutritional and behavior assessments. The email linked students to an encrypted web-based survey. Participation was voluntary and anonymous, and incentives for participation were not offered.

The survey included questions about age, height, weight, undergraduate institution, extracurricular activities, athletic involvement, eating disorder history, and the Eating Attitudes Test-26 (EAT-26) questionnaire. The EAT-26 questionnaire is based on the original EAT-40 questionnaire developed by Garner and Garfinkel to screen for anorexia symptoms. The original questionnaire has strong internal consistency, and is both, sensitive and specific for identifying subjects at increased risk for eating disorders. The abbreviated EAT-26 is highly correlated with the EAT-40 ($r = 0.97$ for female university students and $r = 0.98$ for anorexia nervosa)[51, 52]. Each survey question is scored on a 6-point forced Likert Scale. Scores ≥ 20 on the EAT-26 have traditionally been suggestive of anorexia nervosa or bulimia nervosa[53]. Recently,

scores ≥ 11 have been associated with an increased risk for binge eating disorder[54].

All undergraduates at one university received the recruitment email, but because of email server difficulties, only a sample of students at two of the universities received the email. Surveys were completed by a total of 5144 students. Those who did not report either height or weight and those who did not complete all components of the EAT-26 were excluded from the analysis. Those with a BMI <18.5 were also excluded in case underweight was associated with eating pathologies that could confound obesity analysis. A total of 4201 participants remained eligible for study analysis.

Outcomes

Survey participants were stratified into two groups based on body mass index (BMI) classifications: normal weight ($18.5 kg/m^2 \leq BMI < 25 kg/m^2$) and overweight ($25 kg/m^2 \leq BMI < 30 kg/m^2$) / obese ($BMI \geq 30 kg/m^2$). Dependent variables included total EAT-26 score as well as the validated EAT-26 scores of 11 and 20. Additionally, we assessed the relationship of BMI with purging behaviors, routine physical activity, and previous treatment for eating disorders. Reported Greek (i.e., sorority or fraternity) affiliation was also examined to determine if members of specific social groups were at increased risk of overweight/obesity than the general population of students.

Seven questions hypothesized to be useful screening questions for overweight and obesity were selected from the EAT-26 survey:

1) Find myself preoccupied with food
2) Have gone on eating binges where I feel that I may not stop
3) Vomit after I have eaten
4) Am preoccupied with a desire to be thinner
5) Feel that food controls my life
6) Engage in dieting behaviors
7) Have the impulse to vomit after meals

The responses to the questions were evaluated as dichotomous outcomes, with clustering of "always, usually, and often" responses and "sometimes, rarely, and never" responses. They were then analyzed by BMI classification to determine if overweight and obesity were associated with disordered eating perceptions and behaviors.

Statistical Analysis

Data were analyzed using Stata 8.0 (StataCorp, College Station, TX). Descriptive statistics were calculated for the overall group of respondents based on BMI criteria for normal weight and overweight/obese. For the continuous outcome of BMI, we used the Wilcoxon rank sum test to assess its relationship with total EAT-26 score. Multiple linear regression modeling was performed to examine the relationship between BMI and the following variables: activity level,

extreme weight loss measures, and social affiliations. For the dichotomous outcome of overweight, we used Pearson's chi-square tests to assess associations with specific EAT-26 cut-off scores, physical inactivity, purging behaviors, and previous treatment for eating disorders. Logistic regression was used to determine the relationship between overweight status and the same independent variables.

Results

A total of 5144 students completed the survey and 4201 met eligibility requirements. Of the eligible students, 1522 were from Duke University, 1673 were from the University of North Carolina at Chapel Hill (UNC), and 1001 were from North Carolina State University (NCSU). Since an unknown number of students at UNC and NCSU actually received the survey, the precise response rates are unknown. However, at Duke University, all undergraduates received the survey and the calculated response rate for this population was approximately 26%. Of the eligible respondents, 3574 (67.5%) were female, 4178 (99%) were 18 years or older, and 3457 (82.5%) were Caucasian. Based on BMI, 78.5% of the participants were normal weight, 16.8% were overweight, and 4.7% were obese. Participants came from all years of education, with 18.9% of students reporting Greek life affiliations (Table 2).

Overweight/obese students had higher average total EAT-26 scores than normal-weight students (10 vs. 9, $p = 0.0001$). The EAT-26

was then evaluated as a dichotomous variable to assess if traditional survey cut-off scores showed an association in our population. No association was found with the usual cut off score ≥ 20, yet a modified EAT-26 score of ≥ 11 was associated with overweight such that 31.9% of those who were overweight had an EAT-26 score ≥ 11, while only 27.8% of those with a normal BMI had a score ≥ 11 ($p = 0.016$).

All of the obesity screening questions selected from the EAT-26 were associated with overweight/obese status except for those assessing purging behavior (Table 3). While 11.4% of overweight individuals feared bingeing episodes without an ability to stop, fewer than 8% of normal weight participants had the same fear ($p = 0.001$). Similarly, overweight subjects had a significantly greater preoccupation with food compared to normal weight subjects (33.3% vs. 23.7%) and a greater desire to be thinner (42.4% vs. 31.3%). Additionally, those who were overweight perceived food to control their lives and engaged in dieting behaviors more than those who were normal weight ($p<0.001$).

Multivariate linear regression modeling revealed that mean BMI was associated with Greek affiliation, physical activity level, previous treatment for disordered eating, and year in college (Table 4). The adjusted mean BMI was higher for individuals with more years in college and increased with each year, from 22.7 kg/m^2 for first year students to 24.4kg/m^2 for seniors ($p<0.001$). Overweight participants were also more likely to report complete physical inactivity (46%) than normal weight

participants (37%). More specifically, BMI was greater in those reporting physical inactivity (23.3 vs. 22.9, $p < 0.001$), previous treatment for an eating disorder (23.1 vs. 22.7, $p = 0.013$), and no Greek organization affiliation (23.1 vs. 22.7, $p = 0.015$).

Multiple logistic regression analysis revealed that an EAT-26 score ≥ 11 was associated with an increased risk of overweight/obesity (OR [95% CI] = 1.3 [1.1 – 1.6]). Those who reported a lack of physical activity were more likely to be overweight (OR [95% CI] = 1.4 [1.2 – 1.6]), as were those reporting prior treatment for an eating disorder (OR [95% CI] = 1.7 [1.2 – 2.5]).

Discussion

Obesity is a national problem of increasing proportions, and the college-aged population is at particular risk for developing obesity and maintaining it in adulthood[2, 4]. We found that college students who reported inactivity were more likely to be overweight or obese than their peers. These students also reported a higher frequency of being preoccupied with food, feeling that food controlled their lives, and desiring to be thinner. They also engaged in more dieting and bingeing behaviors than their normal weight peers and had higher total scores on a validated eating disorders screening test.

Since overweight/obesity is often underdiagnosed and undertreated, a screening tool would be helpful in identifying those with

disordered behaviors and perceptions associated overweight[24]. Although the EAT-26 questionnaire has been validated as a screening tool for anorexia nervosa and bulimia nervosa, it has not been used to screen for overweight or obesity. One study tested the accuracy of the EAT-26 in detecting disordered eating behaviors in obese patients who were referred to an outpatient nutrition center[54]. Discriminant analysis showed that an EAT-26 cutoff value of 11, the same value used in our study, was optimal for screening. However, additional diagnostic analyses with different patient populations are required to confirm the usefulness of the EAT-26 for routine clinical use.

In order to develop a useful screening questionnaire for those with obesity related symptoms, characteristic traits and patterns of this population must be identified. Our results suggest that selected questions from the EAT-26 survey may be useful markers for overweight, because we found a positive association between several of the questions and overweight in the college population. Specifically, a preoccupation with food, feeling that food controlled one's life, the desire to be thinner, as well as bingeing and dieting behaviors were all associated with overweight and obesity. These findings suggest that overweight and obesity, like other eating disorders, are associated with distorted eating behaviors and perceptions of food, and thus further evaluation of these attitudes may be useful in the development of a clinically useful screening test. Further, a

more complete understanding of the psychological component of obesity may be crucial in the development of effective treatment interventions.

Since overweight and obesity were secondary outcomes assessed from the original survey data, these results may lack information on several variables related to weight-related outcomes. Additionally, since the study sample was a convenience sample, it may have been biased toward those who were more health conscious than the general population and thus more likely to return the survey. Furthermore, since those who failed to report their height or weight were excluded, obese students may have been underrepresented in the sample because they may have been less willing to report these measures. The large sample size (n=4201), multi-center study base, and descent response rates, however, help overcome some of the sampling limitations. Although the study was limited to self-reported measures, previous studies have suggested that college students report weights and heights accurately, with correlation coefficients of 0.987 and 0.981, respectively [55, 56]. Of note, the study population showed overweight and obesity rates (16.8% overweight and 4.7% obese) similar to the population in the National College Health Risk Behavior Study[1].

Our results suggest that colleges and universities should be more proactive about educating their students on healthy physical activity behaviors. With complete inactivity rates of 37% in normal weight individuals and 46% in overweight individuals, it is clear that students of all

body types are not engaging in sufficient physical activity. Since the college environment is clearly one in which young adults are at risk for obesity, interventions to promote physical activity should be implemented at the institutional level. Increased education about recommended activity levels and physical education requirements can help slow the rising rate of obesity in the college population. However, education alone may not be a sufficient intervention in high risk groups. Since overweight individuals tend to have disordered eating perceptions, a more intensive counseling and behavioral program is likely to be needed to effect change in this subgroup of college students.

Although there seems to be an association between the transition to college and weight gain in young adults, the risk factors and habits influencing young adult weight gain require further evaluation. The data obtained in this study were cross-sectional and thus do not track behaviors over time or assess how the college environment directly influences an individual's normal behaviors. Future research should include longitudinal studies that more closely evaluate BMI and the determinants of obesity, including eating behaviors, physical activity trends, and body image perceptions. A greater understanding of how these determinants change in college students from pre-matriculation through graduation can help promote the development of healthy habits that may last a lifetime.

Addendum to Discussion

Biological Considerations

Physiologically, energy consumption greater than energy expenditure leads to weight gain and puts one at increased risk for overweight/obesity. Studies have found that as college students adapt to life away from home, their normal dietary and activity habits change and are contributing to the weight gain seen during the college years[10-13, 15, 19-21]. In this study population, physical activity was assessed more closely than dietary habits, and the outcomes revealed that complete physical inactivity during college is in fact associated with overweight/obesity ($p<0.001$).

The importance of reducing physical inactivity rates has been demonstrated in studies finding that inactivity tracks from adolescence to adulthood and that decreasing inactivity can have a positive impact on obesity reduction[57, 58]. Even normal weight college students often resort to dietary weight control mechanisms rather than both healthful eating and physical activity, and thus they too may remain inactive throughout their college lives[19]. Therefore, in order to reduce the likelihood of overweight, young adults of all body compositions need to be better educated about physical activity recommendations so that healthier patterns can be developed and carried forth into adulthood.

Overweight/Obesity vs DSM-IV Diagnosed Eating Disorders

In general, there are two main differences between the psychological eating disorders and obesity. First, the behavioral differences between eating disorders and obesity are likely to stem from differences in impulse control. Evidence suggests that in AN and BN, one's restraint and self-control are more prominent than is found in either obesity and thus weight tends to be lower in these groups[36, 41].

Secondly, the psychiatric eating disorders tend to have a greater severity of psychological disturbances than does overweight/obesity. And although obesity is not a psychiatric diagnosis as are AN, BN, and BED, it does share some features with these eating disorders including feelings of ineffectiveness, perfectionist attitudes, low interoceptive awareness, low self esteem, emotional eating, and depressive symptoms[33, 40-42].

In this study, we see that obesity is also associated with distorted perceptions of body image and eating behaviors such that overweight individuals have an increased drive for thinness ($p<0.001$), are preoccupied with food ($p<0.001$), and feel that food controls their lives ($p<0.001$) compared to normal weight students. Such affective tendencies have been positively associated with BMI and the severity of bingeing behaviors, which in turn are correlated with greater body dissatisfaction and dieting frequency [59-61].

The psychological concerns have implications for the treatment of overweight in that a simple dietary intervention or physical education

course may not be sufficient in generating a sustainable reduction in young adult overweight and obesity. Rather, a multifaceted approach which includes education about healthy eating attitudes as well as emotional strengthening and personality evaluation is likely to be more effective in the overweight populations. Assessments of weight loss interventions have suggested that if psychological counseling precedes weight loss efforts, one may be able to maintain their weight loss for a longer duration[32-34].

Overweight/Obesity and BED: How Different are they?

Community samples assessing the prevalence of BED and obesity have found that although the two are associated with one another and are often comorbid, the precise relationship remains undetermined. Similar to those with BED, overweight and obesity are associated with bingeing behaviors without compensatory purging behaviors. In this study, overweight was associated with bingeing in 11.4% of the overweight students ($p = 0.001$), yet showed no association with purging behaviors ($p = 0.874$). Given this relationship, the question of whether obesity is a subset of BED or BED is a subset of obesity remains controversial.

Additionally, the question of which comes first, obesity or bingeing, remains uncertain and existing literature proposes both as plausible mechanisms. In the causal pathway suggesting that obesity precedes bingeing, the belief is that obese persons diet in an attempt to lose weight.

This restrictive behavior leaves their appetites unsatisfied, so they overeat as compensation for the caloric restriction. If disinhibited overcompensation occurs, bingeing episodes can ensue and perpetuate further weight gain[27, 62]. This theory is based on the notion that dieting is a cognitively regulated eating habit that supercedes physiological hunger-satiety cues. When one diets, he or she no longer pays attention to innate hunger cues, and once the cognitive cycle takes over the physiologic one, binge-dieting cycles become problematic and may ultimately result in overweight[63]. Evidence also suggests that the prevalence of bingeing behaviors increases as the degree of obesity increases[29, 31, 33, 35, 64, 65].

On the other hand, proponents of bingeing before obesity hold that binge eaters are a subset of the obese population which has increased body dissatisfaction and psychological pathology that predispose them to uncontrolled bingeing behavior. In this case, binge eating is considered a risk factor for obesity because it is the bingeing behavior that leads to increased caloric intake and ultimately to weight gain [27, 62]. Support for this model has come from studies showing that the mean age of binge eating onset precedes that of both dieting and obesity, and therefore it may be disinhibition that increases bingeing risk rather than dietary restraint as seen in the first model [28, 29, 32, 41, 66-68].

Overweight/Obesity and Bingeing Behaviors

Regardless of the exact relationship between dieting, obesity, and bingeing, evidence suggests that obese binge eaters are a distinct subset of the obese population and make up from 23-46% of the obese population (Figure 1) [32]. As mentioned, bingeing obese individuals tend to have a greater degree of psychopathology than nonbingers, which is likely reflect more on their bingeing behavior than overall weight [29, 33, 39, 41, 42, 65].

The relevance of recognizing a bingeing subgroup within obesity becomes apparent when considering treatment for obese individuals. Since obese bingers seem to be a distinct group with different eating patterns and psychopathology, it is increasingly important that treatment targets the bingeing psychopathology before the weight loss. Similar to eating disorder treatment, the first goal needs to be correction of disordered eating perceptions and behaviors before attention is devoted to the actual weight loss. Evidence suggests that the ability to maintain weight loss is associated with lower psychological distress than the general population, and thus targeting the psychological basis of overweight before the actual weight loss may be more beneficial in achieving long-term successes for reduced rates of overweight[69].

EAT-26 and Screening for Overweight/Obesity

This study elucidated an association between specific Likert questions and overweight, indicating that it may be possible to use similar

questions to develop a screening tool for disordered eating behaviors and attitudes that are correlated with overweight. Although the survey would need validation, five selected questions relating to a preoccupation with food, binging behaviors, a desire to be thinner, a feeling that food controls one's life, and dieting behaviors may be useful in a brief screen that either physicians or student health practitioners could use to evaluate abnormal eating habits perceptions in young adults at risk for overweight and obesity.

Such a survey may be useful not only in identifying high risk individuals, but also in assisting students with reporting their health concerns. Some students may feel more comfortable confronting overweight and obesity through a questionnaire and referral system rather than taking the initiative to approach health professionals on their own. Therefore, a screening tool may help both identify and counsel those who have attitudes and behaviors that may predispose them to obesity.

Overweight/Obesity and Age

This study also discerned that there is some truth to the "Freshman 15" weight gain common to first year college students. On average, the mean BMI of study participants increased with age such that during freshman year, the average BMI was 22.7kg/m^2 but it increased to 24.3kg/m^2 by the time students reached their fourth year of college. This correlates to approximately an 11lb weight gain. The results also showed

that the greatest difference in mean BMI existed between the first and second-year college students and supports the theory that the transition to college is the time when students are most vulnerable to weight gain. Although this data is not longitudinal, the trend does show that average BMI increases with age which is consistent with numerous studies showing this same pattern[2, 4, 5, 17, 22].

Overweight/Obesity and Social Affiliation

Another factor which can influence one's risk for overweight/obesity is his or her social affiliation and peer influences. In general, the college environment is associated with an increased rate of eating pathology such that as many as 80% of American college women are dieting and at least 5% fulfill diagnostic criteria for AN or BN. Hypotheses to explain this trend suggest that the transition to college is associated with changing social roles, a loss of social support, and increased stress which may trigger alterations in normal dietary and physical activity habits and predispose students to weight gain and obesity[7, 50].

In this study, we find that students with a Greek affiliation, both men and women, are less likely to be overweight than those who are not involved with Greek life ($p = 0.001$). The reality of this may come from one of two associations. The first is that sororities and fraternities may place increased pressure on its members be thin, thus students engage in weight loss tactics to keep their weight down. The mechanism of

achieving a low weight, however, may not be healthy as evidenced by the fact that sororities have a higher prevalence of eating disorders than the general college population[6, 7, 46]. The other possibility is that the type of students attracted to Greek organizations are those who are thin and either more likely to be healthy and physically, or to have an eating disorder. Either way, it appears that sorority or fraternity involvement is negatively associated with obesity but positively associated with AN and BN.

Overweight/Obesity and Previous Treatment for Eating Disorders

Finally, the study elucidates that previous treatment for an eating disorder is associated with overweight and obesity. Although the exact disorder for which students sought treatment was not elicited in the questionnaire, the data suggest that overweight and obesity are associated with a lifetime history of eating disorders ($p = 0.0004$). This association is likely to be underestimated in our study because the survey questionnaire refers to a subset of students who report treatment for an eating disorder and excludes those who may have a disorder yet have never received treatment or a formal diagnosis. This relationship suggests that those with a history of disordered eating behaviors should be cautious about eating and activity habits because it appears as though disordered eating behaviors either recur or predispose one to a future eating disorder.

Additionally, this relationship raises the question of treatment efficacy because those who report prior treatment for an eating disorder are also the ones more likely to be overweight/obese. Since we are unsure of when and where these students were treated or for what disorder they were treated, we cannot fully evaluate the efficacy of the treatment regimen. But given that they have received some intervention and are still at risk for overweight, I question if their initial treatment was successful in addressing the underlying pathology. A closer evaluation of treatment programs is needed in order to determine the true efficacy of an intervention, but the fact that previous treatment is associated with increased rates of overweight raises questions about our current treatment regimens and the need for improved practices.

Future Directions

As discussed, there is an association between the transition to college and weight gain in young adults, yet the true nature of this relationship remains unclear. We need to more accurately determine what it is college that triggers weight gain. For instance, if obesity is situational during the college years and reverses itself after graduation, then intense interventions at the college level may not be beneficial for these transient behaviors. In fact, they may be actually harmful because labeling a person with a premature diagnosis of obesity can unfairly affect them later in life with consequences such as increased insurance premiums and

feelings of shame throughout their adult years. Yet if obesity is actually patterned in college and carried forth into adulthood, we need to better target habits that form before and during the college years so as to more effectively prevent the onset of overweight and obesity.

Additionally, further investigation into the biological basis of weight control, dieting, and bingeing behaviors may provide insight into the behaviors that most predispose young adults to overweight and obesity. If we can better elucidate the causal pathway between these behaviors and their associated perceptions, we may be able to more accurately identify risky behaviors and thus intervene through primary preventive measures rather than secondary treatments. Through a better understanding of how the social determinants of obesity interact with the psychological and biological components, we will hopefully be able to target our interventions at the root causes of obesity and more effectively work toward a long-term reduction in the rates of young adult overweight and obesity.

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Figures and Tables

Table 1. Research criteria for binge eating disorder

A. Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:
   (1) Eating, in a discrete period of time (e.g., within any 2-hr period), an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances
   (2) A sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating)

B. The binge eating episodes are associated with three (or more) of the following:
   (1) Eating much more rapidly than normal
   (2) Eating until feeling uncomfortably full
   (3) Eating large amounts of food when not feeling physically hungry
   (4) Eating alone because of being embarrassed by how much one is eating
   (5) Feeling disgusted with oneself, depressed, or very guilty after overeating

C. Marked distress regarding binge eating is present.

D. The binge eating occurs, on average, at least 2 days a week for 6 months.
   Note: The method of determining frequency differs from that used for bulimia nervosa. Future research should address whether the preferred method of setting a frequency threshold is counting the number of days on which binges occur or counting the number of episodes of binge eating.

E. The binge eating is not associated with the regular use of inappropriate compensatory behaviors (e.g., purging, fasting, excessive exercise) and does not occur exclusively during the course of anorexia nervosa or bulimia nervosa.

* Taken from DSM-IV, American Psychiatric Association, 1994.

Table 2: Characteristics of Study Population (n = 4201)

Characteristic, n (%)	All students		BMI 18.5-24.9		BMI ≥25.0	
Gender*						
Female	2,835	(67.5)	2,338	(55.7)	497	(11.8)
Male	1,358	(32.3)	954	(22.7)	404	(9.6)
Age*						
≤17	22	(0.5)	15	(0.4)	7	(0.2)
18	881	(21.0)	708	(16.9)	173	(4.1)
19	1,057	(25.2)	868	(12.1)	189	(4.5)
20	956	(22.8)	729	(10.1)	227	(5.4)
≥21	1,284	(30.5)	977	(23.7)	307	(7.3)
Ethnicity*						
Asian/Pacific Islander	245	(5.8)	218	(5.2)	27	(0.7)
Black/African American	238	(5.7)	151	(3.6)	87	(2.1)
Hispanic/Latino	125	(3.0)	95	(2.3)	30	(0.7)
Native American	21	(0.5)	13	(3.1)	8	(0.2)
White/Non-Hispanic	3,457	(82.5)	2,741	(64.7)	716	(17.1)
Other	107	(2.6)	76	(1.8)	31	(0.7)
School*						
Duke University	1,522	(36.2)	1,242	(29.6)	280	(6.7)
NCSU	1,673	(39.8)	1,228	(29.2)	445	(10.6)
UNC – Chapel Hill	1,001	(23.8)	823	(19.6)	178	(4.2)
Year*						
First Year	1,313	(31.3)	1,060	(25.2)	253	(6.0)
Second Year	980	(23.3)	789	(18.8)	191	(4.6)
Third Year	92	(2.3)	740	(17.6)	222	(5.3)
Fourth Year	804	(19.1)	614	(14.6)	190	(4.5)
≥Fifth year	139	(3.3)	94	(2.2)	45	(1.1)
BMI	4,201	(100.0)	3,298	(78.5)	903	(21.5)
Greek Affiliation	792	(18.9)	655	(15.6)	137	(3.3)
No Physical Activity	1,637	(39.0)	1,225	(29.2)	412	(9.8)
Purging Behavior	242	(5.8)	189	(4.5)	53	(1.3)
EAT-26 Score ≥20	631	(15.0)	493	(11.7)	138	(3.3)
EAT-26 Score ≥11	1,205	(28.7)	917	(2.2)	288	(6.9)

* Missing variables <1% of total population

Table 3: Disordered Eating Behaviors and Perceptions in normal vs. overweight/obese participants (n=4201)

% of participants with characteristic	Normal BMI (18.5-24.9) (n=3298)	Overweight BMI (≥25.0) (n=903)	p-value*
EAT sum	--	--	0.0001†
EAT score ≥20	15.0	15.3	0.803
EAT score ≥11	27.8	31.9	0.016
Have engaged in purging behavior	5.7	5.9	0.874
Always, usually, often preoccupied with food	26.4	33.3	< 0.001
Always, usually, often binge with a fear of not stopping	7.9	11.4	0.001
Always, usually, often vomit after eating	1.8	1.6	0.669
Always, usually, often preoccupied with a desire to be thinner	31.3	42.4	<0.001
Always, usually, often feel that food controls life	11.5	16.1	<0.001
Always, usually, often engage in dieting behavior	21.1	26.9	<0.001
Always, usually, often have the impulse to vomit after meals	4.6	5.3	0.335
Ever treated for Eating Disorder	6.8	4.4	0.010
Sorority/fraternity affiliation	19.9	15.2	0.001
No physical activity	37.1	45.6	<0.001

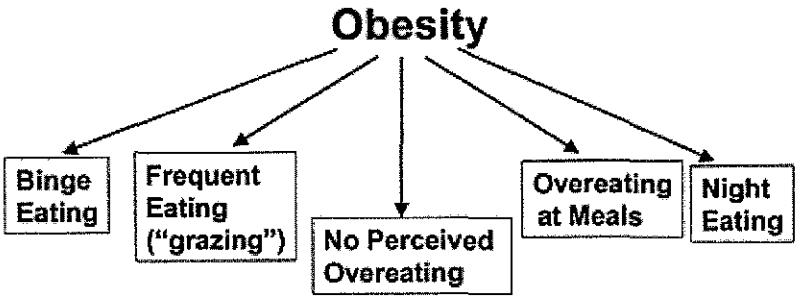
* p-value based on Pearson's χ^2 test.
† p-value based on Wilcoxon Rank-sum test

Table 4: Relationship between student characteristics and BMI (n=4201)

Characteristic	β- coefficient*	Adjusted BMI†	P value‡
EAT score:			
<11	0.12	22.8	<0.001
≥11		23.7	
Year			
First Year		22.7	
Second Year	0.08	23.0	0.031
Third Year	0.17	23.2	0.001
Fourth Year	0.21	23.3	0.002
≥Fifth year	0.36	24.4	<0.001
Sorority/fraternity affiliation	0.06	22.7	0.015
No sorority/fraternity affiliation		23.1	
Physical Activity	0.06	22.9	<0.001
No Physical Activity		23.3	
Never treated for ED	0.05	22.9	0.013
Treated for ED		23.2	

* Regression model x-intercept = -0.15
† Adjusted for gender, age, college, purging behavior, and other listed characteristics
‡ p value based on multivariable linear regression
Abbreviations: EAT = Eating Attitudes Test -26; ED = Eating Disorder

Figure 1: BED as a behavioral subtype of obesity*



*Taken from Devlin MJ, Goldfein JA, Dobrow I; 2003[39].

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